Population Density

Density, defined in Chapter 1 as the number of people occupying an area of land, can be computed in several ways, including arithmetic density, physiological density, and agricultural density. These measures of density help geographers to describe the distribution of people in comparison to available resources.

Arithmetic Density

Geographers most frequently use **arithmetic density**, which is the total number of people divided by total land area. (This measure is also called *population density*.) Geographers rely on the arithmetic density to compare conditions in different countries because the two pieces of information needed to calculate the measure—total population and total land area—are easy to obtain.

For example, to compute the arithmetic or population density for the United States, we can divide the population (approximately 300 million people) by the land area (approximately 9.6 million square kilometers, or 3.7 million square miles). The result shows that the United States has an arithmetic density of 31 persons per square kilometer (80 persons per square mile). By comparison, the arithmetic density is much higher in South Asia. In Bangladesh, it is approximately 1,050 persons per square kilometer (2,700 persons per square mile), and in India it is 350 (900). On the other hand, the arithmetic density is only 3 persons per square kilometer (8 persons per square mile) in Canada and 3 (7) in Australia (Figure 2–4).

Arithmetic density varies even more within individual countries. In the United States, for example, New York County (Manhattan Island) has a population density of approximately 26,200 persons per square kilometer (68,000 persons per square mile), whereas Loving County, Texas, has a population density of approximately 0.03 persons per square kilometer (0.08 per square mile). In Egypt the arithmetic density is only 75 persons per square kilometer (195 persons per square mile) overall, but it is 3,900 persons per square kilometer (10,000 persons per square mile) in the delta and valley of the Nile River.

Arithmetic density enables geographers to compare the number of people trying to live on a given piece of land in different regions of the world. Thus, arithmetic density answers the "where" question. However, to explain *why* people are not uniformly distributed across Earth's surface, other density measures are more useful.

Physiological Density

A more meaningful population measure is afforded by looking at the number of people per area of a certain type of land in a region. Land suited for agriculture is called *arable land*. In a region, the number of people supported by a unit area of arable land is called the **physiological density** (Figure 2–5). For example, in the United States the physiological density is 172 persons per square kilometer (445 per square mile) of arable land. This contrasts sharply with Egypt, which has 2,580 persons per square kilometer (6,682 per square mile) of arable land. This large difference in physiological densities demonstrates that crops grown on a hectare of land in Egypt must feed far more people than in the United States.

The higher the physiological density, the greater the pressure that people may place on the land to produce enough food. Physiological density provides insights into the relationship between the size of a population and the availability of resources in a region.

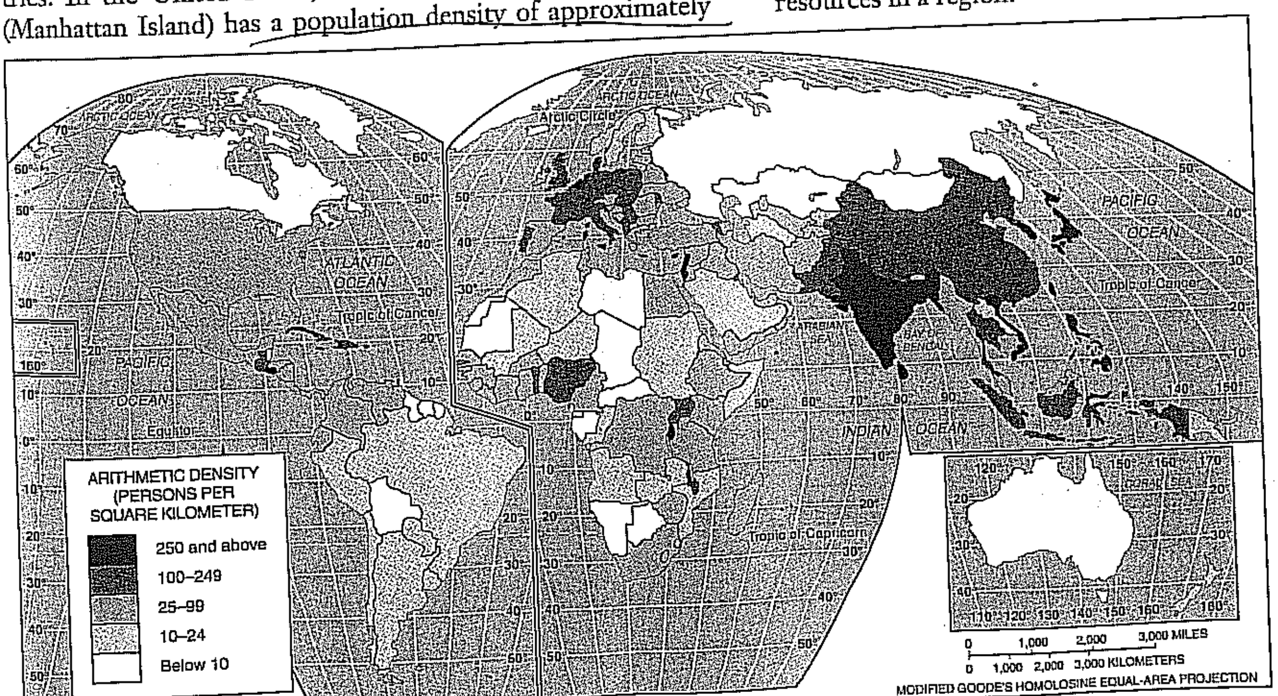

FIGURE 2–4 Arithmetic density. Arithmetic, or population, density is the total number of people divided by the total land area. The highest population densities are found in Asia, Europe, and Central America, whereas the lowest are in North and South America and Australia.

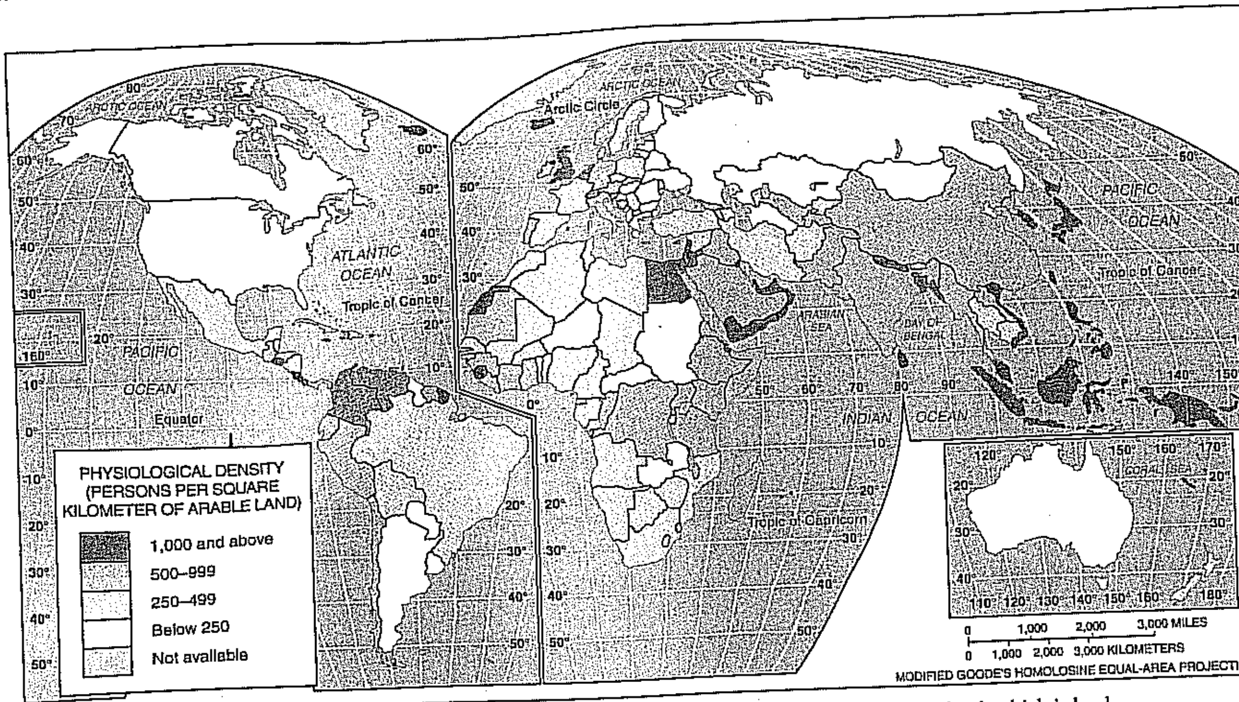

FIGURE 2–5 Physiological density. Physiological density is the number of people per unit area of arable land, which is land suitable for agriculture. Physiological density is a better measure than arithmetic density of the relationship between population and the availability of resources in a society.

Comparing physiological and arithmetic densities helps geographers to understand the capacity of the land to yield enough food for the needs of the people. In Egypt, for example, the large difference between the physiological density (2,580 people per square kilometer of arable land) and arithmetic density (75 persons per square kilometer over the entire country) indicates that most of the country's land is unsuitable for intensive agriculture. In fact, all but 5 percent of the Egyptian people live in the Nile River valley and delta, because it is the only area in the country that receives enough moisture (by irrigation from the river) to allow intensive cultivation of crops (Table 2–1).

Agricultural Density

Two countries can have similar physiological densities, but they may produce significantly different amounts of food because of different economic conditions. **Agricultural density** is the ratio of the number of farmers to the amount of arable land. This density measure helps account for economic differences. For example, the United States has an extremely low agricultural density (1 farmer per square kilometer of arable land), whereas Egypt has a very high density (826 farmers per square kilometer of arable land). MDCs have lower agricultural densities because technology and finance allow a few people to farm extensive land areas and feed many people. This frees most of the MDC population to work in factories, offices, or shops rather than in the fields.

To understand the relationship between population and resources in a country, geographers examine a country's physiological and agricultural densities together. As shown in Table 2–1, the physiological densities of both Bangladesh and the Netherlands are high, but the Dutch have a much lower agricultural density than the Bangladeshi. Geographers conclude that both the Dutch and Bangladeshi put heavy pressure on the land to produce food, but the more efficient Dutch agricultural system requires fewer farmers than does the Bangladeshi system.

TABLE 2–1 | Measures of Density in Selected Countries, Expressed as Population per Square Kilometer

	ARITHMETIC DENSITY	PHYSIOLOGICAL DENSITY	AGRICULTURAL DENSITY	PERCENT FARMERS	PERCENT ARABLE
Canada	3	71	2	3	9
United States	31	172	2	1	19
Egypt	75	2,580	826	32	2
United Kingdom	247	1,069	16	2	25
Japan	338	2,907	145	5	11
India	350	699	419	60	56
Netherlands	400	1,798	72	4	27
Bangladesh	1,050	1,838	1,158	63	67

Similarly, the Netherlands has a much higher physiological density than does India but a much lower agricultural density. This difference demonstrates that, compared with India, the Dutch have extremely limited arable land to meet the needs of their population. (Recall from Chapter 1 how the Dutch have built dikes and created polders, areas of land made usable by draining water from them.) However, the highly efficient Dutch farmers can generate a large food supply from a limited resource.

KEY ISSUE 2

Where Has the World's Population Increased?

- Natural increase
- Fertility
- Mortality

After identifying where people are distributed across Earth's surface, we can describe the locations where the numbers of people are increasing. Population increases rapidly in places where many more people are born than die, increases slowly in places where the number of births exceeds the number of deaths by only a small margin, and declines in places where deaths outnumber births.

The population of a place also increases when people move in and decreases when people move out. This element of population change—migration—is discussed in Chapter 3.

The word *crude* means that we are concerned with society as a whole rather than a refined look at particular individuals or groups. In communities with an unusually large number of people of a certain age—such as a college town—we may study separate birth rates for women of each age. These numbers are *age-specific birth rates* rather than CBRs. In communities with large numbers of older people, demographers may compute separate death rates for males and females or for each group.

Natural Increase

Geographers most frequently measure population change in a country or the world as a whole through three measures—crude birth rate, crude death rate, and natural increase rate.

- **Crude birth rate (CBR)** is the total number of live births in a year for every 1,000 people alive in the society. A CBR of 20 means that for every 1,000 people in a country, 20 babies are born over a 1-year period.
- **Crude death rate (CDR)** is the total number of deaths in a year for every 1,000 people alive in the society. Comparable to the CBR, the CDR is expressed as the annual number of deaths per 1,000 population.
- **Natural increase rate (NIR)** is the percentage by which a population grows in a year. It is computed by subtracting CDR from CBR, after first converting the two measures from numbers per 1,000 to percentages (numbers per 100). Thus if the CBR is 20 and the CDR is 5 (both per 1,000), then the NIR is 15 per 1,000, or 1.5 percent. The term natural means that a country's growth rate excludes migration.

The world NIR during the first decade of the twenty-first century is 1.2, meaning that the population of the world was growing each year by 1.2 percent. The world NIR is lower today than its all-time peak of 2.2 percent in 1963, and it has declined sharply during the past decade. However, the NIR during the second half of the twentieth century was high by historical standards (refer to Table 2–2 later in this chapter on page 59).

About 80 million people are being added to the population of the world annually. That number represents a decline from the historic high of 87 million in 1989 (Figure 2–6). The number of people added each year has dropped much more slowly than the NIR because the population base is much higher now than in the past. World population increased from 3 to 4 billion in 14 years, from 4 to 5 billion in 13 years, and from 5 to 6 billion in 12 years. As the base continues to grow in the twenty-first century, a change of only one-tenth of 1 percent would produce very large swings in population growth.

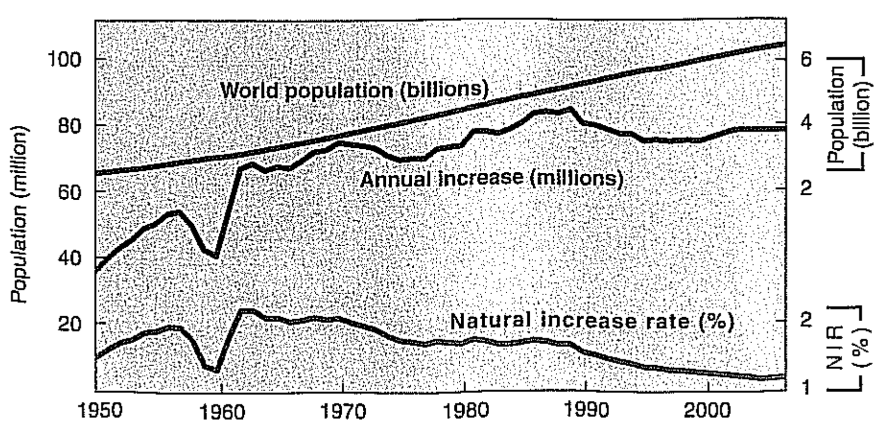

FIGURE 2–6 World population growth, 1950–2005. The percentage by which the population grew (that is, the natural increase rate [NIR]) declined during the late twentieth century from its historic peak in the early 1960s, but the number of people added each year did not decline very much, because with world population increasing from 2.5 to more than 6 billion people during the period, the percentage was applied to an ever larger base.